Engineering Silk Biomaterials for Cancer Therapy

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2D models are failing to predict the accuracy and efficiency of cancer therapeutics. Thus 3D culture systems are adapted to unwind true structural and functional cancerous microenvironment. *In situ*, cancer microenvironment contains extracellular matrix (ECM) and diverse cells (stem and immune cells). The most abundant cancerous ECM is collagen, playing critical role in cancer metastasis. Silk protein fibroin is structurally homologous with collagen. Structural homology with naïve disease ECM and ability to adapt different morphologies as per prerequisites of application, enhances its prospect to be explored for cancer modelling and therapy. Porous silk sponges are able to serve as ECM support for breast and liver carcinoma, leading to development of functional solid hypoxic tumors with drug sensitivity. This improves the understanding of cell-ECM interaction in disease progression and therapeutic response. Stem cells are further incorporated within this hypoxic model to unwind the role of cellular cross-talk in cancer metastasis to secondary sites such as bone. Further, the structural diversity of silk biomaterials allows to deliver anti-cancer therapeutics by means of nanoparticle with target specificity imparted by folate conjugation. However, the exploitation of potential biopolymer like silk in cancer is at neonatal stage. Foreseen applications include mimicking of mechano-transducing cancerous ECM using flexibility and mechanical robustness of silk, designing of organ-on-a-chip and micro-tumors using silk. (Supported by Department of Biotechnology [BT/PR10941/MED/32/333/2014], Indian Council of Medical Research [5/13/12/2010/NCD-III], Govt. of India. SCK currently holds ERA Chair under EU Framework Programme for Research and Innovation Horizon 2020 FoReCaST - agreement number nº 668983)